

**CLAIMS**

1. A process for recovering sulphur from a feed gaseous stream containing hydrogen sulphide and ammonia, comprising the steps of:
  - 5 a) introducing the feed gaseous stream into a combustion region in a Claus furnace;
  - b) supplying to the combustion region pure oxygen or oxygen-enriched air containing at least 80 mole per cent of oxygen;
  - 10 c) burning in the combustion region a portion of the hydrogen sulphide content of the feed gaseous stream to form sulphur dioxide and water vapour, a proportion of the sulphur dioxide reacting with residual hydrogen sulphide in the furnace to form sulphur vapour;
  - 15 d) providing temperature conditions in the Claus furnace to ensure complete destruction of the ammonia content of the feed gaseous stream;
  - e) withdrawing an effluent gas stream from the furnace comprising sulphur vapour, water vapour, hydrogen sulphide, and sulphur dioxide;
  - 20 f) condensing sulphur vapour out of the effluent gas stream to form a sulphur-vapour depleted gas stream;
  - 25 g) subjecting the sulphur-vapour depleted effluent gas stream to an upstream and at least one downstream stage of catalytic reaction of hydrogen sulphide to form further sulphur vapour;
- 30

- 24 -

- h) condensing the further sulphur vapour downstream of each said stage of catalytic reaction, and withdrawing a tail gas containing residual hydrogen sulphide and sulphur dioxide;
  - 5 i) reducing the sulphur dioxide content of the tail gas to hydrogen sulphide;
  - j) condensing water vapour out of the reduced tail gas to form a water vapour-depleted reduced tail gas;
  - 10 k) dividing the water vapour-depleted reduced tail gas into a first portion which is recycled at least in part to the combustion region and a second portion which is discharged from the process, wherein the first portion comprises at least 60% by volume of the water vapour-depleted reduced tail gas; and
  - 15 l) controlling the rate of recycle of the said first portion to the combustion region so as to maintain the said temperature conditions to ensure complete destruction of the ammonia and attainment of at least a desired minimum percentage conversion of hydrogen sulphide, and passing any excess first portion to a part of the Claus furnace remote from the combustion region and/or to the upstream catalytic stage.
- 25 2. A process according to claim 1, in which the second portion of the water vapour-depleted reduced tail gas is sent to an incinerator.
- 30 3. A process according to claim 1 or claim 2, in which the temperature of the gas exiting the combustion region of the Claus furnace is monitored and the rate of recycle of the first portion of the water vapour-depleted reduced tail gas to the combustion region is controlled so as to

maintain the monitored temperature at or above a chosen value which ensures essentially complete destruction of ammonia.

4. A process according to any one of the preceding claims, in which any excess first portion is introduced into the Claus furnace remote from its combustion region or into the upstream stage of catalytic reaction to form further sulphur vapour.  
5
5. A process according to claim 4, in which any excess first portion is introduced into an intermediate region of the upstream stage of catalytic reaction to form further sulphur vapour.  
10
6. A process according to any one of the preceding claims, in which the said first portion constitutes from 65 to 95% by volume of the water vapour-depleted reduced tail gas.  
15
7. A process according to any one of the preceding claims, in which the said first portion is introduced into the combustion region separately from the oxygen or oxygen-enriched air.  
20
8. A process according to any one of the preceding claims, in which flow of the first portion of the water vapour-depleted, reduced tail gas is assisted by operation of a blower or compressor downstream of the water condensation.  
25
9. A process according to claim 8, in which the second portion of the water vapour-depleted, reduced tail gas is taken from downstream of the compressor or blower.  
30
10. A process according to any one of the preceding claims, in which the second portion of the water vapour-depleted, reduced tail gas is treated so as to recover hydrogen sulphide therefrom and the recovered

- 26 -

hydrogen sulphide is recycled to a stage of the process in which Claus reaction takes place.

11. A process according to claim 10, in which the treatment of the said second portion is performed by absorption of hydrogen sulphide therefrom.  
5
12. A process according to any one of the preceding claims, in which the ratio of the flow rate of the first portion of the water vapour-depleted reduced tail gas to the flow rate of the second portion thereof is fixed.  
10
13. A process for recovering sulphur from a feed gas stream comprising hydrogen sulphide, including subjecting the feed gas stream to Claus reaction between hydrogen sulphide and sulphur dioxide in a train of stages comprising, in sequence, at least one thermal stage and a first catalytic stage, taking at least part of the flow through the train from downstream of the first catalytic stage, reducing its sulphur dioxide content to hydrogen sulphide to form a reduced gas flow, condensing water vapour out of the reduced gas flow, and introducing a  
15 temperature moderating stream of the resulting water depleted reduced gas flow into an intermediate region of the first catalytic stage.  
20
14. A process according to claim 13, in which the introduction of the said temperature moderating stream is controlled so as to keep the temperature of the gas flow out of the first catalytic stage at or above a chosen temperature.  
25
15. A process according to claim 14, in which the said chosen temperature is at least 5 °C above the dew point of the sulphur.

- 27 -

16. A process according to any one of the claims 13 to 15, in which the region of the first catalytic stage upstream of the introduction of the temperature moderating stream is operated at a temperature which ensures essentially complete destruction of any carbon oxysulphide  
5 and any carbon disulphide present.
17. A process according to any one of the preceding claims, in which the water vapour-depleted reduced gas flow is heated to above the sulphur solidification stage upstream of introduction into the first catalytic stage.

10